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Network DVR

Network DVR (NDVR), or NPVR (Network Personal Video Recorder), or Remote Storage Digital Video Recorder (RS-DVR) is a network-based digital video recorder (DVR) stored at the provider's central location rather than at the consumer's private home. Traditionally, media content was stored in a subscriber's set-top box hard drive, but with NDVR the service provider owns a large number of servers, on which the subscribers' media content is stored. The term RS-DVR is used by Cablevision for their version of this technology.

Overview

NDVR is a consumer service where real-time broadcast television is captured in the network on a server allowing the end user to access the recorded programs at will, rather than being tied to the broadcast schedule. The NDVR system provides time-shifted viewing of broadcast programs, allowing subscribers to record and watch programs at their convenience, without the requirement of a local PVR device. It can be considered as a "PVR that is built into the network" – however that is slightly misleading unless the word "personal" is changed to "public" for this context.

NDVR subscribers can choose from the programmes available in the network-based library, when they want, without needing yet another device or remote control. However, many people would still prefer to have their own PVR device, as it would allow them to choose exactly what they want to record. Local PVR bypasses the strict rights and licensing regulations, as well as other limitations, that often prevent the network itself from providing "on demand" access to certain programmes.

In contrast, RS-DVR (*Remote Storage Digital Video Recorder*) refers to a service where a subscriber can record a program and store it on the network. A stored program is only available to the person who recorded it. Should any two persons record the same program, it must for legal reasons be recorded and stored as separate copies. Essentially implementing a traditional DVR with network based storage.

In Greece, On Telecoms offers an NPVR service to all subscribers in their basic package with all the programming of all major national Greek TV channels for the last 72 hours. The user has to sign in their contract that they agree that the company will record national programming of the last 72 hours **for** them so that they can get around any legal implications (like the ones mentioned in the NPVR article) as this service would work like a personal PVR.

Cablevision litigation in the U.S.

After Cablevision announced the RS-DVR in March 2006, several content providers including 20th Century Fox, Universal Studios, and Walt Disney sued Cablevision in federal district court. The content providers sought a permanent injunction that would effectively prevent Cablevision from implementing the system. The content providers prevailed at the district court level, and Cablevision appealed. On August 5, 2008, the 2nd U.S. Circuit Court of Appeals reversed the lower court decision that found the use of RS-DVRs in violation of copyright law.^[1] It agreed with Cablevision's argument that a RS-DVR should be treated essentially the same as a customer owned DVR. Only the location of the DVR really differs.^[2]

Certain content providers began the process of appealing to the U.S. Supreme Court, seeking cert in late 2008. The Supreme Court delayed hearing the case and instead referred it to the United States Solicitor General's office for the federal government's opinion on the case. In June 2009 the US Supreme Court refused to hear a final appeal in the Cablevision remote DVR case, thereby bringing the years-long litigation to a close.

Future of RS-DVRs

As the Cablevision litigation had a favorable outcome, the future looks bright for RS-DVR systems. Many major U.S. cable companies are expected to implement their own RS-DVR systems, as RS-DVRs allow wider access to DVRs at a lesser cost to subscribers and innovative new methods of advertising that appeal to advertisers.

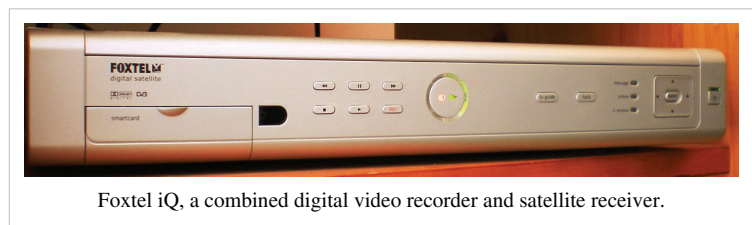
NDVRs have been launched in countries like Singapore (recordTV.com), Italy (Faucet PVR), Germany (shift.tv), Finland (tvkaista.fi) and other European countries.

References

- [1] *Cartoon Network LP, LLLP v. CSC Holdings, Inc.*, 536 F.3d 121 (2d Cir. 2008)
- [2] Multichannel News 29.31 (August 11, 2008) p2.

Digital video recorder

A **digital video recorder (DVR)** or **personal video recorder (PVR)** is a consumer electronics device or application software that records video in a digital format to a disk drive, USB flash drive, SD memory card or other local or networked mass storage device. The term includes set-top boxes (STB) with direct to disk recording facility, portable media players (PMP) with recording, recorders (PMR as camcorders that record onto Secure Digital memory cards and software for personal computers which enables video capture and playback to and from disk. A television set with built-in digital video-recording facilities was introduced by LG in 2007,^[1] followed by other manufacturers.



Foxtel iQ, a combined digital video recorder and satellite receiver.



V+, a combined digital video recorder and cable TV receiver.

DVR adoption has rapidly accelerated in recent years: in January 2006, ACNielsen recorded 1.2% of US households having a DVR but by February 2011, this number had accelerated to 42.2% of viewers in the United States.^[2]

History

Hard-disk based digital video recorders

Consumer digital video recorders ReplayTV and TiVo were launched at the 1999 Consumer Electronics Show in Las Vegas, USA. Microsoft also demonstrated a unit with DVR capability, but this did not become available until the end of 1999 for full DVR features in Dish Network's DISHplayer receivers. TiVo shipped their first units on March 31, 1999. ReplayTV won the "Best of Show" award in the video category^[3] with Netscape co-founder Marc Andreessen as an early investor and board member,^[4] but TiVo was more successful commercially. While early legal action by media companies forced ReplayTV to remove many features such as automatic

commercial skip and the sharing of recordings over the Internet,^[5] newer devices have steadily regained these functions while adding complementary abilities, such as recording onto DVDs and programming and remote control facilities using PDAs, networked PCs, and Web browsers.

Hard-disk based digital video recorders make the "time shifting" feature (traditionally done by a VCR) much more convenient, and also allow for "trick modes" such as pausing live TV, instant replay of interesting scenes, chasing playback where a recording can be viewed before it has been completed, and skipping of advertising. Most DVRs use the MPEG format for compressing the digitized video signals.

Video recording capabilities have become an essential part of the modern set-top box, as TV viewers have wanted to take control of their viewing experiences. As consumers have been able to converge increasing amounts of video content on their set-tops, delivered by traditional 'broadcast' [Cable, Satellite and terrestrial] as well as IP networks, the ability to capture programming and view it whenever they want has become a must-have function for many consumers.

Digital video recorders tied to a video service

At the 1999 CES, Dish Network demonstrated the hardware that would later have DVR capability with the assistance of Microsoft software.^[6] Users would have to wait until June 1999 for simple time shifting capabilities in the 7100, rebranded as the DISHPlayer satellite receiver,^[7] which also included WebTV Networks internet TV.^[6] By the end of 1999 the Dishplayer had full DVR capabilities and within a year, over 200,000 units were sold.^{[8] [9]}

In the UK, digital video recorders are often referred to as "plus boxes" (such as BSKYB's Sky+ and Virgin Media's V+ which integrates an HD capability, and the subscription free Freesat+ and Freeview+). British Sky Broadcasting markets a popular combined EPG and DVR as Sky+. TiVo launched a UK model in 2000, and while no longer on sale, the subscription service is still maintained. South African based Africa Satellite TV beamer Multichoice recently launched their DVR which is available on their Dstv platform. In addition to ReplayTV and TiVo, there are a number of other suppliers of digital terrestrial (DTT) DVRs, including Thomson, Topfield, Fusion, Pace Micro Technology, Humax, AC Ryan Playon and Advanced Digital Broadcast (ADB).

Many satellite, cable and IPTV companies are incorporating digital video recording functions into their set-top box, such as with DirecTiVo, DISHPlayer/DishDVR, Scientific Atlanta Explorer 8xxx from Time Warner, Total Home DVR from AT&T U-verse, Motorola 6xxx from Comcast, Moxi Media Center by Digeo (available through Charter, Adelphia, Sunflower, Bend Broadband, and soon Comcast and other cable companies), or Sky+. Astro introduced



Back view of a TiVo Series2 5xx-generation unit.

their DVR system, called Astro MAX, which was the first PVR in Malaysia. Sadly, it was phased out two years after its introduction.

In the case of digital television, there is no *encoding* necessary in the DVR since the signal is already a digitally encoded MPEG stream. The digital video recorder simply stores the digital stream directly to disk. Having the broadcaster involved with, and sometimes subsidizing, the design of the DVR can lead to features such as the ability to use interactive TV on recorded shows, pre-loading of programs, or directly recording encrypted digital streams. It can, however, also force the manufacturer to implement non-skippable advertisements and automatically expiring recordings.

In the United States, the FCC has ruled that starting on July 1, 2007, consumers will be able to purchase a set-top box from a third-party company, rather than being forced to purchase or rent the set-top box from their cable company.^[10] This ruling only applies to "navigation devices," otherwise known as a cable television set-top box, and not to the security functions that control the user's access to the content of the cable operator.^[11] The overall net effect on digital video recorders and related technology is unlikely to be substantial as standalone DVRs are currently readily available on the open market.

Introduction of dual tuners


In 2003 many Satellite and Cable providers introduced dual-tuner digital video recorders. In the UK, BSkyB introduced their first PVR Sky+ with dual tuner support in 2001. These machines have two independent tuners within the same receiver. The main use for this feature is the capability to record a live program while watching another live program simultaneously or to record two programs at the same time, possibly while watching a previously recorded one. Kogan Technologies introduced a dual-tuner PVR in the Australian market allowing free-to-air television to be recorded on a removable hard drive. Some dual-tuner DVRs also have the ability to output to two separate television sets at the same time. The PVR manufactured by UEC (Durban, South Africa) and used by Multichoice and Scientific Atlanta 8300DVB PVR have the ability to view two programs while recording a third using a triple tuner.

Where several digital subchannels are transmitted on a single RF channel, some PVRs can record two channels and view a third, so long as all three subchannels are on two channels (or one).^[12]

In the United States, DVRs were used by 32 percent of all TV households in 2009, and 38 percent by 2010, with viewership among 18 to 40 year-olds 40 percent higher in homes that have them.^[13]

Integrated TV-set digital video recorders

Integrated LCD DVR



Side view: Even with all the DVR components inside the LCD monitor is still slim.

| | |
|------------|---------|
| Media type | LCD DVR |
|------------|---------|

Digital video recorders are often integrated in the LCD and LED TV-sets. These systems let the user simplify the wiring and installation, because they do not use ports (SCART or HDMI), and they only need to use only one device and power and the same remote control instead of two.

There are examples of security systems integrated into such DVRs, and thus they are capable of recording more input streams in parallel. Some of them include wireless ports such as (Bluetooth and WiFi), so they can play and record files to or from cellular phones and other devices. Such devices can also be used as disguised observation systems, displaying pictures or videos as typical store display.

VESA Compatible digital video recorders

VESA Compatible DVR



The underside of a VESA compatible DVR

| | |
|--------------|------------------|
| Media type | DVR |
| Developed by | Lorex Technology |

VESA compatible DVR are designed small and light enough to mount to the back of an LCD monitor that has clear access to VESA mounting holes (100x100mm). This allows users to use their own personal monitor to save on cost and space.

PC-based digital video recorders

Software and hardware is available which can turn personal computers running Microsoft Windows, Linux, and Mac OS X into DVRs, and is a popular option for home-theater PC (HTPC) enthusiasts.

NAS DVR

An increasing number of Pay-TV operators are offering their subscribers the ability to create their own digital recording platform capable of storing video, audio, photos, etc. These customizable hardware and software platforms enable subscribers to attach their own NAS (Network Attached Storage) hard drives or solid state/flash memory to set-tops which do not have their own internal storage. This minimizes an operator's investment, while offering subscribers the flexibility to create a digital recording solution that meets their specific requirements.

One such product is DVR-LiteTM), a vertically integrated hardware and software platform from Advanced Digital Broadcast, available on its Set-Back Box, which allows external storage to added by subscribers.

Linux

There are many free DVR applications available for Linux, each released as free and open source software under the GNU General Public License:

- MythTV
- VDR
- LinuxMCE
- Freevo ^[14]

A commercial and proprietary application called SageTV is available for most popular Linux distributions.

Mac OS

Elgato makes a series of digital video recording devices called EyeTV. The software supplied with each device is also called EyeTV, and is available separately for use on compatible third-party tuners from manufacturers such as Pinnacle, TerraTec, and Hauppauge.

SageTV provides DVR software for the Mac with built in placeshifting for watching TV remotely and sells and supports the Hauppauge HVR-950, myTV.PVR and HDHomeRun hardware with its DVR software. SageTV software also includes the ability to watch YouTube and other online video with a remote control.

MythTV (see above) also runs under Mac OS X, but most recording devices are currently only supported under Linux. Precompiled binaries are available for the MythTV front-end, allowing a Mac to watch video from (and control) a MythTV server running under Linux.

Apple provides applications in the FireWire software developer kit which allow any Mac with a FireWire port to record the MPEG2 transport stream from a FireWire equipped cable box (for example: Motorola 62xx, including HD streams). Applications can also change channels on the cable box via the firewire interface. Only broadcast channels can be recorded as the rest of the channels are encrypted. *FireRecord* (formerly *iRecord*) is a free scheduled-recording program derived from this SDK.

Windows

There are several free digital video recording applications available for Microsoft Windows including GB-PVR, MediaPortal, and Orb (web-based remote interface).

There are also several commercial applications available including CyberLink, SageTV, Beyond TV, Showshifter, InterVideo WinDVR, the R5000-HD and Meedio (now a dead product - Yahoo! bought most of the company's technology and discontinued the Meedio line, and rebranded the software Yahoo! Go - TV, which is now a free product but only works in the U.S. ^[15]). Most TV tuner cards come bundled with software which allows the PC to record television to hard disk. ^[16] For example, Leadtek's WinFast DTV1000 digital TV card comes bundled with the WinFast PVR2 software, which can also record analog video from the card's composite video input socket. ^[17]

Windows Media Center is a DVR software by Microsoft bundled with the Media Center edition of Windows XP, the Home Premium / Ultimate editions of Windows Vista, as well as most editions of Windows 7.

Source video

Television and video are terms that are sometimes used interchangeably, but differ in their technical meaning. Video is the visual portion of television, whereas television is the combination of video and audio modulated onto a carrier frequency (i.e., a television channel) for delivery. Most DVRs can record both.

Analog sources overview

The first digital video recorders were designed to record Analog television in NTSC, PAL or SECAM formats.

To record an analog signal a few steps are required. TV tuner card tunes into a particular frequency and then functions as a frame grabber, breaking the lines into individual pixels and quantizing them into a format that a computer can comprehend. Then the series of frames along with the audio (also sampled and quantized) are compressed into a manageable format, like MPEG-2, usually in software.

Analog broadcast copy protection

Many mass-produced consumer DVRs implement a copy-protection system called CGMS-A or *Copy Generation Management System—Analog*. This encodes a pair of bits in the VBI of the analog video signal that specify one of the following settings:

- Copying is freely allowed
- Copying is prohibited
- Only one copy of this material may be made
- This is a copy of material for which only one copy was allowed to be made, so no further copies are allowed.

CGMS-A information may be present in analog broadcast TV signals, and is preserved when the signal is recorded and played back by analog VCRs, which of course don't understand the meanings of the bits. But the restrictions still come into effect when you try to copy the tape onto a PVR.

DVRs such as Tivo also detect and act upon^[18] analogue protection systems such as Macrovision and DCS Copy Protection which were originally designed to block copying on analog VCRs.

Digital sources overview

Recording digital signals is generally a straightforward capture of the binary MPEG data being received. No expensive hardware is required to quantize and compress the signal (as the television broadcaster has already done this in the studio).

DVD-based PVRs available on the market as of 2006 are not capable of capturing the full range of the visual signal available with high definition television (HDTV). This is largely because HDTV standards were finalized at a later time than the standards for DVDs. However, DVD-based PVRs can still be used (albeit at reduced visual quality) with HDTV since currently available HDTV sets also have standard A/V connections.

ATSC broadcast

ATSC television broadcasting is primarily used in North America. The ATSC data stream can be directly recorded by a digital video recorder, though many DVRs record only a subset of this information (that can later be transferred to DVD). An ATSC DVR will also act as a Set-top box, allowing older televisions or monitors to receive digital television.

Copy protection

The U.S. FCC attempted to limit the abilities of DVRs with its "broadcast flag" regulation. Digital video recorders that had not won prior approval from the FCC for implementing "effective" digital rights management would have been banned from interstate commerce from July 2005, but the regulation was struck down on May 6, 2005.

DVB

DVB Digital television contains audio/visual signals that are broadcast over the air in a digital rather than analog format. The DVB data stream can be directly recorded by the DVR. Autonomous devices (this is, that can be used without a computer/tablet) that can store in an external hard disk are called a telememory.^[19]

Digital cable and satellite television

Recording satellite or digital cable signals on a digital video recorder can be more complex than recording analog signals or broadcast digital signals. There are several different transmission schemes, and the video streams may be encrypted to restrict access to subscribers only.

A satellite or cable set-top box both decrypts the signal if encrypted, and decodes the MPEG stream into an analog signal for viewing on the television. In order to record cable or satellite digital signals the signal must be captured after it has been decrypted but before it is decoded; this is how DVRs built into set-top boxes work.

Cable and satellite providers often offer their own digital video recorders along with a service plan. These DVRs have access to the encrypted video stream, and generally enforce the provider's restrictions on copying of material even after recording.

DVD

Many DVD-based DVRs have the capability to copy content from a source DVD (ripping).

In the U.S. this is prohibited under the Digital Millennium Copyright Act if the disc is encrypted. Most such DVRs will hence not allow recording of video streams from encrypted movie discs.

Digital camcorders

A digital camcorder combines a camera and a digital video recorder.

Some DVD-based DVRs incorporate connectors that can be used to capture digital video from a camcorder. Some editing of the resulting DVD is usually possible, such as adding chapter points.

Some digital video recorders can now record to solid state flash memory cards (called *flash camcorders*). They generally use Secure Digital cards, can include wireless connections (Bluetooth and Wi-Fi), and can play SWF files. There are some digital video recorders that combine video and graphics in real time to the flash card, called DTE or "direct to edit". These are used to speed-up the editing workflow in video and television production, since linear videotapes do not then need to be transferred to the edit workstation (see Non-linear editing system).

File formats, resolutions and file systems

DVRs can usually record and play H.264, MPEG-4 Part 2, MPEG-2 .mpg, MPEG-2 .TS, VOB and ISO images video, with MP3 and AC3 audio tracks. They can also display images (JPEG and PNG) and play music files (MP3 and Ogg).

Some devices can be updated to play and record in new formats.

Recordings from standard-definition television usually have 480p/i/576p/i while HDTV is usually in 720p/1080i.

DVRs usually record in proprietary filesystems for copy protection, although some can use FAT filesystems.

Applications

TV recording

TV DVRs generally use the electronic programming guide (EPG).

Security

Digital video recorders configured for physical security applications record video signals from closed circuit television cameras for detection and documentation purposes. Many are designed to record audio as well. DVRs have evolved into devices that are feature rich and provide services that exceed the simple recording of video images that was previously done through VCRs. A DVR CCTV system provides a multitude of advanced functions over VCR technology including video searches by event, time, date and camera. There is also much more control over quality and frame rate allowing disk space usage to be optimized and the DVR can also be set to overwrite the oldest security footage should the disk become full. In some DVR security systems remote access to security footage using a PC can also be achieved by connecting the DVR to a LAN network or the internet. videoNEXT also makes a NVR surveillance application for the Mac OS X. Some of the latest professional digital video recorders include video analytics firmware, to enable functionality such as 'virtual tripwire' or even the detection of abandoned objects on the scene.

Security DVRs may be categorized as being either PC based or embedded. A PC based DVR's architecture is a classical personal computer with video capture cards designed to capture video images. An embedded type DVR is specifically designed as a digital video recorder with its operating system and application software contained in firmware or read only memory.

Hardware features

Hardware features of security DVRs vary between manufacturers and may include but are not necessarily limited to

- Designed for rack mounting or desktop configurations.
 - Single or multiple video inputs with connector types consistent with the analogue or digital video provided such as coaxial cable, twisted pair or optical fiber cable. The most common number of inputs are 1, 2, 4, 8, 16 and 32. Systems may be configured with a very large number of inputs by networking or bussing individual DVRs together.
 - Looping video outputs for each input which duplicates the corresponding input video signal and connector type. These output signals are used by other video equipment such as matrix switchers, multiplexers, and video monitors.
 - Controlled outputs to external video display monitors.
 - Front panel switches and indicators that allow the various features of the machine to be controlled.
 - Network connections consistent with the network type and utilized to control features of the recorder and to send and/or receive video signals.
 - Connections to external control devices such as keyboards.
-

- A connection to external pan-tilt-zoom drives that position cameras.
- Internal CD, DVD, VCR devices typically for archiving video.
- Connections to external storage media.
- Alarm event inputs from external security detection devices, usually one per video input.
- Alarm event outputs from internal detection features such as motion detection or loss of video.

Software features

Software features vary between manufacturers and may include but are not necessarily limited to

- User selectable image capture rates either on an all input basis or input by input basis. The capture rate feature may be programmed to automatically adjust the capture rate on the occurrence of an external alarm or an internal event
- Selectable image resolution either on an all input basis or input by input basis. The image resolution feature may be programmed to automatically adjust the image resolution on the occurrence of an external alarm or an internal event.
- Compression methods determine quality of playback. H.264 hardware compression offers fast transfer rates over the internet with high quality video.
- Motion detection: Provided on an input by input basis, this feature detects motion in the total image or a user definable portion of the image and usually provides sensitivity settings. Detection causes an internal event that may be output to external equipment and/or be used to trigger changes in other internal features.
- Lack of motion detection. Provided on an input by input basis, this feature detects the movement of an object into the field of view and remaining still for a user definable time. Detection causes an internal event that may be output to external equipment and/or used to trigger changes in other internal features.
- Direction of motion detection. Provided on an input by input basis, this feature detects the direction of motion in the image that has been determined by the user as an unacceptable occurrence. Detection causes an internal event that may be output to external equipment and/or be used to trigger changes in other internal features.
- Routing of input video to video monitors based on user inputs or automatically on alarms or events.
- Input, time and date stamping.
- Alarm and event logging on appropriate video inputs.
- Alarm and event search.
- One or more sound recording channels.
- Archival.
- Commercial hopping. Rather than fast-forwarding through commercials, an undocumented feature of the TiVo box is that the user can reprogram the tab-to-end button by entering a sequence of buttons on the remote: SELECT-PLAY-SELECT-3-0-SELECT and listening for the confirming chimes that signal the feature has been activated (or deactivated). The tab-to-end button no longer jumps to the end of a recording when so activated: It skips 30 seconds, which is the length of U.S. commercials. In combination with the 8-second rewind button, most viewers can completely miss commercial breaks in programming.

Privacy concerns

Some digital video recorders which are designed to send information to a service provider over a telephone line, Internet, (or any other way) can gather and send real-time data on users' viewing habits.^[20]

The future of TV advertisements

Digital video recorders are also changing the way television programs advertise products. Watching pre-recorded programs allows users to fast-forward through commercials, and some technology allows users to remove commercials entirely. Half of viewers in the United States, for example, use DVRs to skip commercials entirely.^[13] This feature has been controversial for the last decade, with major television networks and movie studios claiming it violates copyright and should be banned.

In 1985, an employee of Honeywell's Physical Sciences Center, David Rafner, first described a drive-based DVR designed for home TV recording, time-slipping, and commercial skipping. U.S. Patent 4,972,396 focused on a multi-channel design to allow simultaneous independent recording and playback. Broadly anticipating future DVR developments, it describes possible applications such as streaming compression, editing, captioning, multi-channel security monitoring, military sensor platforms, and remotely piloted vehicles.

The first DVR which had a built-in commercial skipping feature introduced in 1999 by ReplayTV at the Consumer Electronics Show in Las Vegas. In 2002 five owners of the ReplayTV DVR sued the main television networks and movie studios, asking the federal judge to uphold consumers' rights to record TV shows and skip commercials claiming that features such as commercial skipping help parents protect their kids from excessive consumerism. ReplayTV was purchased by SONICblue in 2001 and on March 2003 SONICblue filed for Chapter 11 bankruptcy after fighting a copyright infringement suit over the ReplayTV's ability to skip commercials. In 2007 DirecTV purchased the remaining assets of ReplayTV. A third-party add-on for Windows Media Center called "DVRMSToolbox" has the ability to skip commercials. There is a command-line program called Comskip that detects commercials in an MPEG-2 file and saves their positions to a text file. This file can then be fed to a program like MEncoder to actually remove the commercials.

Many speculate that television advertisements will be eliminated altogether, replaced by advertising in the TV shows themselves. For example, *Extreme Makeover: Home Edition* advertises Sears, Kenmore, Kohler, and Home Depot by specifically using products from these companies, and some sports events like the Sprint Cup of NASCAR are named after sponsors.

Another type of advertisement shown more and more, mostly for advertising TV shows on the same channel, is where the ad overlays the bottom of the TV screen, blocking out some of the picture. "Banners", or "Logo Bugs", as they are called, are referred to by media companies as Secondary Events (2E). This is done in much the same way as severe weather warnings are done. Sometimes these take up only 5-10% of the screen, but in the extreme, can take up as much as 25% of the viewing area. Some even make noise or move across the screen. One example of this is the 2E ads for *Three Moons Over Milford* in the months before its premiere. A video taking up approximately 25% of the bottom-left portion of the screen would show a comet impacting into the moon with an accompanying explosion, during another television program.

Because of this widely used new technology, advertisers are now looking at a new way to market their products on television. An excerpt from the magazine *Advertising Age* reads: "As advertisers lose the ability to invade the home, and consumer's minds, they will be forced to wait for an invitation. This means that they have to learn what kinds of advertising content customers will actually be willing to seek out and receive."^[21]

With ad skipping and the time-sensitive nature of certain ads, advertisers are wary of buying commercial time on shows that are heavily digitally video-recorded.^[22] However, technology today makes it possible for networks to insert ads dynamically on videos being played in DVRs. Advertisers could inject time-relevant ads to recorded programs when the program is viewed. This way the ads could be not just topical but also personalized to viewers

interests. DirectTV in March 2011 signed an arrangement with NDS Group to enable the delivery of such addressable advertisement.^[23] It is believed that viewers prefer to forward ads, than to switch the channel. By switching channels viewers will have the probability of skipping the beginning of their program. Users might switch to a channel that is also showing ads. Having the ability to pause, rewind, and forward live TV gives users a chance to change the channel less times. Forwarding ads can have a later affect on the viewer. Ads that get the viewers attention will influence the viewers to rewind and watch what was missed.^[24]

Patent and copyright litigation

On July 14, 2005, Forgent Networks filed suit^[25] against various companies alleging infringement on U.S. Patent 6285746^[26], entitled "Computer controlled video system allowing playback during recording". The listed companies included EchoStar, Directv, Charter Communications, Cox Communications, Comcast, Time Warner, and Cable One.

Scientific-Atlanta and Motorola, the manufacturers of the equipment sold by the above mentioned companies, filed a counter-suit against Forgent Networks claiming that their products do not violate the patent, and that the patent is invalid. The two cases were combined into case 6:06-cv-208, filed in the United States District Court for the Eastern District of Texas, Tyler Division.

According to court documents, on June 20, 2006, Motorola requested that the United States Patent and Trademarks Office reexamine the patent, which was first filed in 1991, but has been amended several times.^[27]

On March 23, 2007 Cablevision Systems Corp lost a legal battle against several Hollywood studios and television networks to introduce a network-based digital video recorder service to its subscribers.^[28] However, on August 4, 2008, Cablevision won its appeal. John M. Walker Jr., a Second Circuit judge, declared that the technology "would not directly infringe" on the media companies' rights.^[29] An appeal to the Supreme Court was rejected.

In court, the media companies argued that network digital video recorders were tantamount to video-on-demand, and that they should receive license fees for the recording. Cablevision and the appeals court disagreed. The company noted that each user would record programs on his or her own individual server space, making it a DVR that has a "very long cord."^[29]

Notes

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External links

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- How-to guides for setting up open source DVRs on your pc (<http://www.pvrweb.com/>)
- Comparison Chart of PVR FLOSS Media Centers (<http://www.telematicsfreedom.org/en/flossmediacenter>)
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